CLAIMS

What is claimed is:

1. An apparatus for fluid level management in a media coating system, comprising:

a supply item for the storage of a media coating fluid;

an applicator having a trough for receiving the media coating fluid from the supply item;

a fluid level detection sensor located within the applicator, wherein the fluid level detection sensor measures whether the media coating fluid level within the trough of the applicator is either above or below a threshold position and generates an output signal; and

a controller for receiving the output signal and controlling delivery of the media coating fluid from the supply item to the applicator.

2. The apparatus of claim 1, wherein the fluid level detection sensor comprises:

a. a first probe made of conductive material having a connecting end and a measuring end;

b. a second probe made of conductive material having a connecting end and a measuring end, wherein the first probe and the second probe are spaced apart from each other such that an impedance between the measuring end of the first probe and the measuring end of the second probe can be measured;

c. an oscillator having an output, wherein the output is electrically coupled to the connecting end of the first probe; and

d. a detector having an input and an output, wherein the input is electrically coupled to the output of the oscillator and the connecting end of the first probe for receiving signal related to the measured impedance between the measuring end of the first probe and the measuring end of the second probe and the output generates an output signal to the controller.

3. The apparatus of claim 2, wherein the connecting end of the second probe is coupled to ground.

4. The apparatus of claim 2, wherein the second probe is shorter than the first probe.

5. The apparatus of claim 2, wherein the conducting material includes a stainless steel.

6. The apparatus of claim 2, wherein each of the measuring end of the first probe and the measuring end of the second probe has a surface contactable with the media coating fluid, and the impedance between the measuring end of the first probe and the measuring end of the second probe depends on the area of the surface of each of the measuring ends that is in contact with the media coating fluid.

7. The apparatus of claim 6, wherein when at least one of the first probe and the second probe is not in contact with the media coating fluid within the trough of the applicator, the measured impedance between the measuring end of the first probe and the measuring end of the second probe is high.

8. The apparatus of claim 6, wherein when both of the first probe and the second probe are in contact with the media coating fluid within the trough of the

applicator, the measured impedance between the measuring end of the first probe and the measuring end of the second probe is low.

9. The apparatus of claim 1, wherein the fluid level detection sensor comprises a single point level sensor.

10. The apparatus of claim 9, wherein the single point level sensor comprises:

a. a float;

b. a magnet associated with the float generating a magnetic field; and

c. a magnetic switch positioned in the inside surface of the trough substantially near or at the threshold position, wherein the float floats on the surface of the media coating fluid; and wherein when the level of the media coating fluid moves toward to the threshold position, the magnetic switch is activated by the magnetic field of the magnet, thereby generating an output signal indicating the level of the media coating fluid.

11. The apparatus of claim 10, wherein the magnetic switch is a Hall effect switch.

12. The apparatus of claim 10, wherein the magnetic switch is a reed switch.

13. The apparatus of claim 9, wherein the single point level sensor comprises an optical sensor.

14. The apparatus of claim 9, wherein the single point level sensor comprises an ultrasonic sensor.

15. The apparatus of claim 9, wherein the single point level sensor comprises a thermistor.

16. The apparatus of claim 9, wherein the single point level sensor comprises a capacitor.

17. The apparatus of claim 1, wherein the applicator delivers onto a print medium a substantially consistent coat weight of the media coating fluid.

18. The apparatus of claim 17, wherein the applicator further comprises a snout in fluid communication with the trough, and a substantially consistent coat weight of the media coating fluid is delivered to the print medium through the snout.

19. The apparatus of claim 1, wherein if the fluid level detection sensor indicates that the media coating fluid level is low, then the controller determines an optimum time in which to transfer media coating fluid from the supply item to the applicator.

20. The apparatus of claim 1, wherein the fluid level detection sensor will perform a closed-loop status verification test to ensure that the fluid level detection sensors are functioning properly before initiating any attempt to refill the applicator with media coating fluid.

21. The apparatus of claim 1, further comprising an optical sensor for detecting the presence of the supply item.

22. The apparatus of claim 21, wherein the optical sensor comprises a spring-loaded arm.

23. The apparatus of claim 1, wherein media coating fluid is delivered to the applicator through a valve assembly located within the supply item.

24. A fluid level detection sensor for measuring a media coating fluid level in a media coating system, wherein the media coating system has an applicator with a trough to contain the media coating fluid and the fluid level detection sensor is located within the applicator, comprising:

a. a first probe made of conducting material having a connecting end, a measuring end and a body there between;

b. a second probe made of conducting material having a connecting end, a measuring end and a body therebetween, wherein the first probe and the second probe are spaced apart from each other such that an impedance between the measuring end of the first probe and the measuring end of the second probe can be measured;

c. an oscillator having an output, wherein the output is electrically coupled to the connecting end of the first probe; and

d. a detector having an input and an output, wherein the input is electrically coupled to the output of the oscillator and the connecting end of the first probe for receiving signal related to the measured impedance between the measuring end of the first probe and the measuring end of the second probe and the output generates an output signal.

25. The sensor of claim 24, wherein the connecting end of the second probe is coupled to ground.

26. The sensor of claim 24, wherein the first probe is shorter than the second probe.

27. The sensor of claim 24, wherein the conducting material includes a stainless steel.

28. The sensor of claim 24, wherein each of the measuring end of the first probe and the measuring end of the second probe has a surface contactable with the media coating fluid, and the impedance between the measuring end of the first probe and

the measuring end of the second probe depends on the area of the surface of each of the measuring ends that is in contact with the media coating fluid.

29. The sensor of claim 28, wherein when at least one of the first probe and the second probe is not in contact with the media coating fluid within the trough of the applicator, the measured impedance between the measuring end of the first probe and the measuring end of the second probe is high.

30. The sensor of claim 28, wherein when both of the first probe and the second probe are in contact with the media coating fluid within the trough of the applicator, the measured impedance between the measuring end of the first probe and the measuring end of the second probe is low.

31. The sensor of claim 24, wherein the oscillator outputs an AC signal through a resistor and capacitor.

32. The sensor of claim 31, wherein the oscillator outputs an AC signal through the resistor in the form of a square wave.

33. The sensor of claim 31, wherein the amplifier comprises a comparator.

34. The sensor of claim 24, wherein the detector comprises:

a. a field-effect transistor having a drain, a gate and a source, wherein the source of the field-effect transistor is grounded and the gate is electrically coupled to the output of the oscillator; and

b. a frequency discriminator having an input electrically coupled to the drain of the field-effect transistor and an output, wherein the field-effect transistor receives an output signal having a frequency from the oscillator output and allows the output signal to pass if the amplitude of the output signal is greater than the gate threshold voltage, and the frequency discriminator receives the output signal

and at the output generates a logic low if the frequency of the oscillator output is higher than a threshold frequency, or a logic high if the frequency of the oscillator output is lower than the threshold frequency, respectively.

35. The sensor of claim 34, wherein if the amplitude of the output signal is smaller than the gate threshold voltage, the field-effect transistor blocks the output signal.

36. The sensor of claim 34, wherein the detector further comprises a capacitor electrically coupled between the output of the oscillator and the gate of the field-effect transistor.

37. The sensor of claim 24, further comprising a fail-safe circuit performing a closed-loop status verification test to verify if the fluid level detection sensor functions properly before the applicator is filled with the media coating fluid.

38. The sensor of claim 37, wherein the first probe has two wires, and the second probe has two wires, and the fail-safe circuit comprises:

a. a transistor having a drain, a gate and a source; and

b. a capacitor electrically coupled between the drain of the transistor and a wire of the first probe, wherein the source of the transistor is electrically coupled to a wire of the second probe, and the gate of the transistor is adapted to receive a control signal.

39. The sensor of claim 38, wherein the two wires from each probe establishes conductivity only through the body of the probe.

40. The sensor of claim 39, further comprising at least one nylon washer to isolate the first and second wires of each probe from each other.

41. The sensor of claim 24, wherein each of the bodies of the first and second probes is substantially cylindrical.

42. A method for fluid level management in a media coating system, wherein the media coating system has an applicator with a trough to contain the media coating fluid, comprising the steps of:

a. determining media coating fluid level within the applicator against a predetermined upper refill limit and a predetermined lower refill limit; and

b. selectively transferring media coating fluid from a supply item to the trough of the applicator depending on the level of the media coating fluid against the predetermined upper refill limit and the predetermined lower refill limit and the status of the media coating system.

43. The method of claim 42, wherein the step of determining media coating fluid level comprises the steps of:

a. measuring media coating fluid level within the applicator;
b. generating a signal indicating that the fluid level is low if the media coating fluid level is lower than the predetermined upper refill limit;
c. counting the number of pages coated since the fluid level reaches the predetermined upper refill limit; and
d. determining if a media coating request is received.

44. The method of claim 43, wherein the step of selectively transferring media coating fluid, when a media coating request is received, comprises the steps of:

a. holding a media coating operation responsive to the media coating request if the number of pages coated since the fluid level reaches

the predetermined upper refill limit exceeds a first page number corresponding to the predetermined lower refill limit; and

b. transferring media coating fluid from a supply item to the trough of the applicator.

45. The method of claim 43, wherein the step of selectively transferring media coating fluid, when a media coating request is received, comprises the steps of:

a. holding a media coating operation responsive to the media coating request if the number of pages coated since the fluid level reaches the predetermined upper refill limit is greater than the first page number corresponding to the predetermined upper refill limit but smaller than the second page number; and

b. transferring media coating fluid from a supply item to the trough of the applicator when the media coating operation is accomplished.

46. The method of claim 45, wherein the step of transferring media coating fluid, when a media coating request is received, comprises the steps of:

a. holding the media coating operation responsive to the media coating page request once the number of pages coated is greater than the first page number corresponding to the predetermined lower refill limit; and

b. transferring media coating fluid from a supply item to the trough of the applicator.

47. The method of claim 43, wherein the step of selectively transferring media coating fluid, when a media coating request is not received, comprises the steps of:

a. transferring media coating fluid from a supply item to the trough of the applicator if the number of pages coated since fluid level reaches the upper refill limit, is greater than the first page number corresponding to the predetermined upper refill limit.

48. The method of claim 42, further comprising the steps of:

    a. detecting the presence of the supply item; and

    b. detecting the presence of the media coating fluid in the supply item.

49. The method of claim 48, further comprising the step of replacing the supply item with a new supply item if no media coating fluid is detected in the supply item.

50. The method of claim 48, where the step of detecting the presence of the supply item is accomplished by the use of an optical sensor.

51. The method of claim 43, further comprising the steps of using a fluid level detection sensor to measure media coating fluid level within the applicator and performing a closed-loop status verification test to ensure that the fluid level detection sensor is functioning properly before the step of transferring the media coating fluid from the supply item to the applicator is initiated.

52. The method of claim 51, wherein the fluid level detection sensor has a two probes configuration, and the step of using a fluid level detection sensor to measure media coating fluid level within the applicator is accomplished by measuring an impedance between the two probes.

53. The method of 43, wherein the media coating system comprises a printer.

54. The method of 53, wherein the media coating fluid includes ink and the media coating operation comprises a printing operation delivering the ink from the applicator to at least one sheet of paper.

55. The method of 43, wherein the media coating system comprises a copy machine.

56. The method of 43, wherein the media coating system comprises a fax machine.

57. A system for fluid level management in a media coating system, wherein the media coating system has an applicator with a trough to contain the media coating fluid, comprising:

a. means for determining media coating fluid level within the applicator against a predetermined upper refill limit and a predetermined lower refill limit; and

b. means for selectively transferring media coating fluid from a supply item to the trough of the applicator depending on the level of the media coating fluid against the predetermined upper refill limit and the predetermined lower refill limit and the status of the media coating system.

58. The system of claim 57, wherein the means for determining media coating fluid level comprises:

a. means for measuring media coating fluid level within the applicator;

b. means for generating a signal indicating that the fluid level is low if the media coating fluid level is lower than the predetermined upper refill limit;

c. means for counting the number of pages coated since the fluid level reaches the predetermined upper refill limit; and

d. means for determining if a media coating request is received.

59. The system of claim 57, wherein the means for selectively transferring media coating fluid, when a media coating request is received, performs the steps of:

a. holding a media coating operation responsive to the media coating request if the number of pages coated since the fluid level reaches

the predetermined upper refill limit exceeds a first page number corresponding to the predetermined lower refill limit; and

b. transferring media coating fluid from a supply item to the trough of the applicator.

60. The system of claim 57, wherein the means for selectively transferring media coating fluid, when a media coating request is received, performs the steps of:

a. performing a media coating operation responsive to the media coating request if the number of pages coated since the fluid level reaches the predetermined upper refill limit is greater than the first page number corresponding to the predetermined upper refill limit but smaller than first second page number; and

b. transferring media coating fluid from a supply item to the trough of the applicator when the media coating operation is accomplished.

61. The system of claim 60, wherein the means for selectively transferring media coating fluid, when a media coating request is received, performs the steps of:

a. holding the media coating operation responsive to the media coating page request once the number of pages coated is greater than the first page number corresponding to the predetermined lower refill limit; and

b. transferring media coating fluid from a supply item to the trough of the applicator.

62. The system of claim 59, wherein the means for selectively transferring media coating fluid, when a media coating request is not received, performs the step of transferring media coating fluid from a supply item to the trough of the applicator if the number of pages coated is greater than the first page number corresponding to the predetermined upper refill limit.

63. The system of claim 57, further comprising:

a. means for detecting the presence of the supply item; and

b. means for detecting the presence of the media coating fluid in the supply item.

64. The system of claim 57, wherein the means for detecting the presence of the supply item comprises an optical sensor.

65. A method for fluid level management in a media coating system, wherein the media coating system has an applicator with a trough to contain the media coating fluid, comprising the steps of:

a. determining media coating fluid level within the applicator against a predetermined upper refill limit and a predetermined lower refill limit;

b. determining whether a media coating operation is in progress; and

c. transferring media coating fluid from a supply item to the trough of the applicator when the level of the media coating fluid is lower than the predetermined lower refill limit and a media coating operation is in progress.

66. The method of claim 65, further comprising the step of:

a. holding the media coating operation until the transferring step is accomplished; and

b. resuming the media coating operation.

67. The method of claim 65, further comprising the steps of:

a. continuing a media coating operation when the level of the media coating fluid is lower than the predetermined upper refill limit but higher than the predetermined lower refill limit; and

b. transferring media coating fluid from a supply item to the trough of the applicator when the level of the media coating fluid is lower

than the predetermined lower refill limit, or the media coating operation is accomplished.

68. The method of claim 65, further comprising the step of continuing a media coating operation when the level of the media coating fluid is higher lower than the predetermined upper refill limit but higher than the predetermined lower refill.

69. The method of claim 65, further comprising the step of transferring media coating fluid from a supply item to the trough of the applicator when the level of the media coating fluid is lower than the predetermined upper refill limit.

70. A system for fluid level management in a media coating system, wherein the media coating system has an applicator with a trough to contain the media coating fluid, comprising:

a. means for determining media coating fluid level within the applicator against a predetermined upper refill limit and a predetermined lower refill limit;

b. means for determining whether a media coating operation is in progress; and

c. means for transferring media coating fluid from a supply item to the trough of the applicator when the level of the media coating fluid is lower than the predetermined lower refill limit and a media coating operation is in progress.

71. The system of claim 70, further comprising:

a. means for holding the media coating operation until the transferring step is accomplished; and

b. means for resuming the media coating operation.

72. The system of claim 70, further comprising:

a. means for continuing a media coating operation when the level of the media coating fluid is lower than the predetermined upper refill limit but higher than the predetermined lower refill; and

b. means for transferring media coating fluid from a supply item to the trough of the applicator when the level of the media coating fluid is lower than the predetermined lower refill limit, or the media coating operation is accomplished.

73. The system of claim 70, further comprising means for continuing a media coating operation when the level of the media coating fluid is lower than the predetermined upper refill limit but higher than the predetermined lower refill.

74. The system of claim 70, further comprising means for transferring media coating fluid from a supply item to the trough of the applicator when the level of the media coating fluid is lower than the predetermined upper refill limit.